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Research Expedition to Explore Ocean Salinity, Climate - Briefing Materials

NASA-funded researchers are making final preparations at the Woods Hole Oceanographic Institution (WHOI) in Woods Hole, Mass., for an ocean-going campaign designed to shed new light on the link between ocean salinity and shifts in global precipitation patterns.

The research voyage is part of a multi-year mission called the Salinity Processes in the Upper Ocean Regional Study (SPURS). The new data also will help calibrate the salinity measurements NASA's Aquarius instrument has been collecting from space. SPURS scientists aboard the research vessel Knorr leave Sept. 6 from Woods Hole. The researchers will spend about three weeks deploying instruments and taking measurements before sailing to the Azores to complete the voyage on Oct. 9. For more information on SPURS, contact Steve Cole at stephen.e.cole@nasa.gov or Stephanie Murphy at samurphy@whoi.edu.

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Briefing Panelists

- Raymond Schmitt, senior scientist, Woods Hole Oceanographic Institution
- Dave Fratantoni, associate scientist, Woods Hole Oceanographic Institution
- Eric Lindstrom, physical oceanography program scientist, NASA Headquarters

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Raymond Schmitt

IMAGE 1

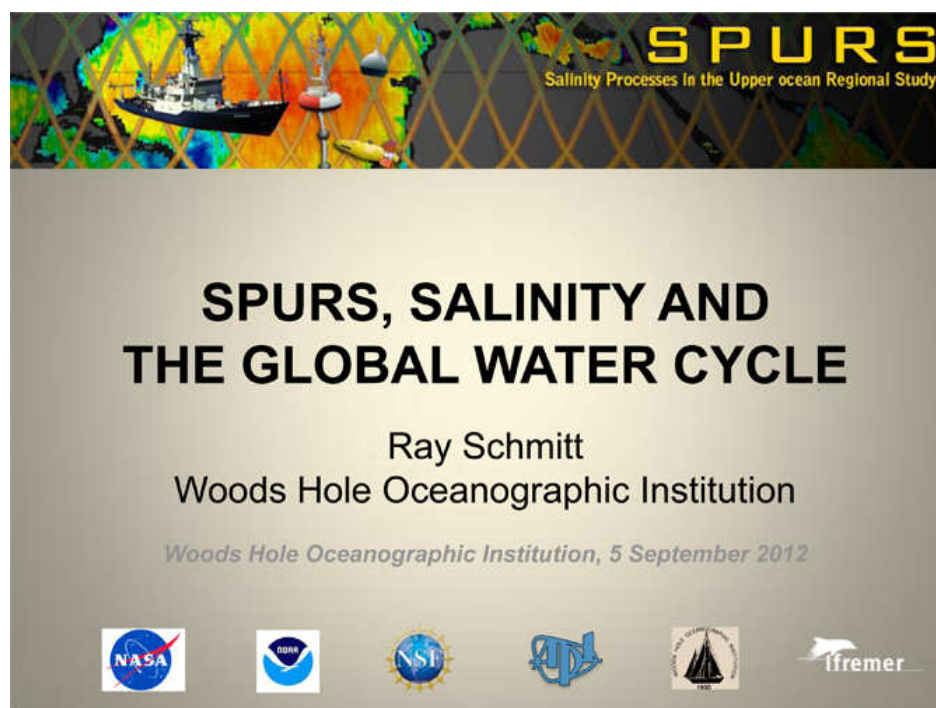
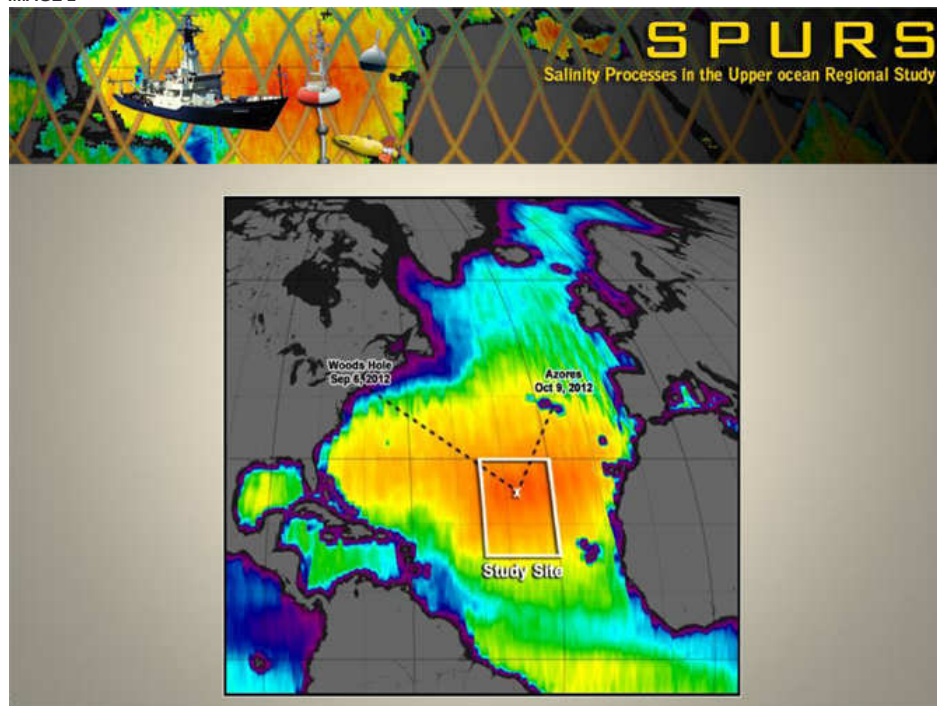


IMAGE 2



The Salinity Processes in the Upper Ocean Regional Study (SPURS) research cruise will study a spot known as the Atlantic surface salinity maximum, located halfway between the Bahamas and the western coast of North Africa.

IMAGE 3

Extreme Drought And Flooding On The Rise



Texas 2011

2010 and 2011: wettest years on record.
2012: hottest and driest?

Will the extreme weather continue?

Key question for climate change: how much will the water cycle intensify?

The oceans may hold the answer.

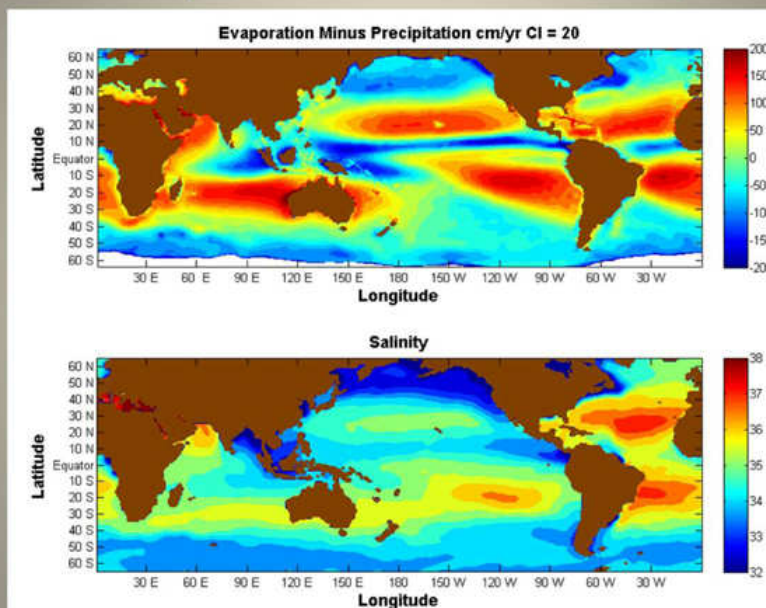


New York 2011

One of the most worrisome impacts of climate change is a possible acceleration of the global water cycle leading to more frequent droughts and floods.

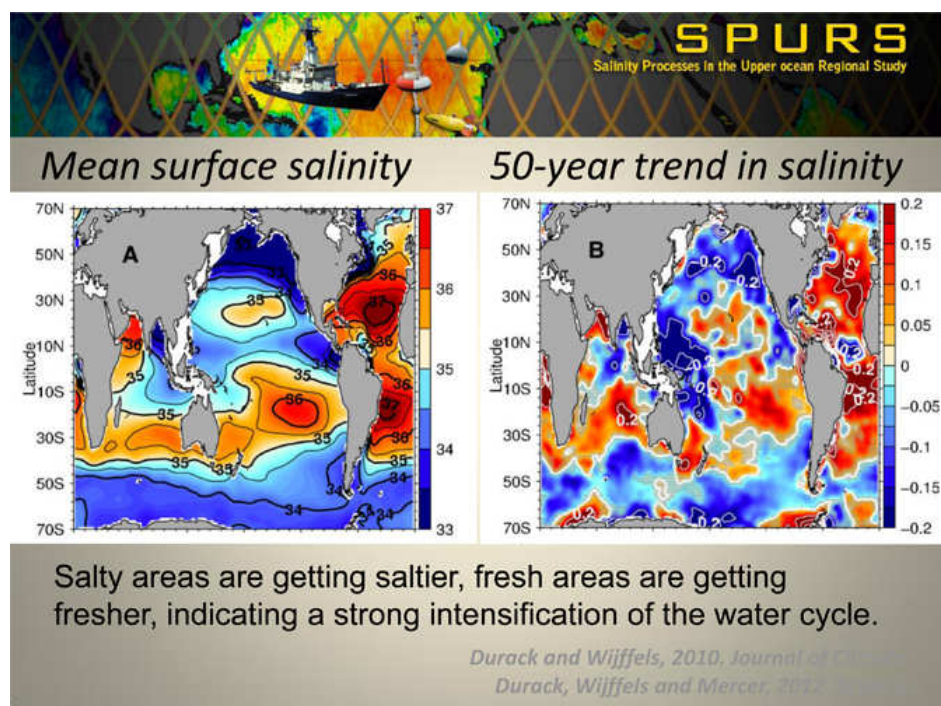
IMAGE 4

Salinity And The Global Water Cycle



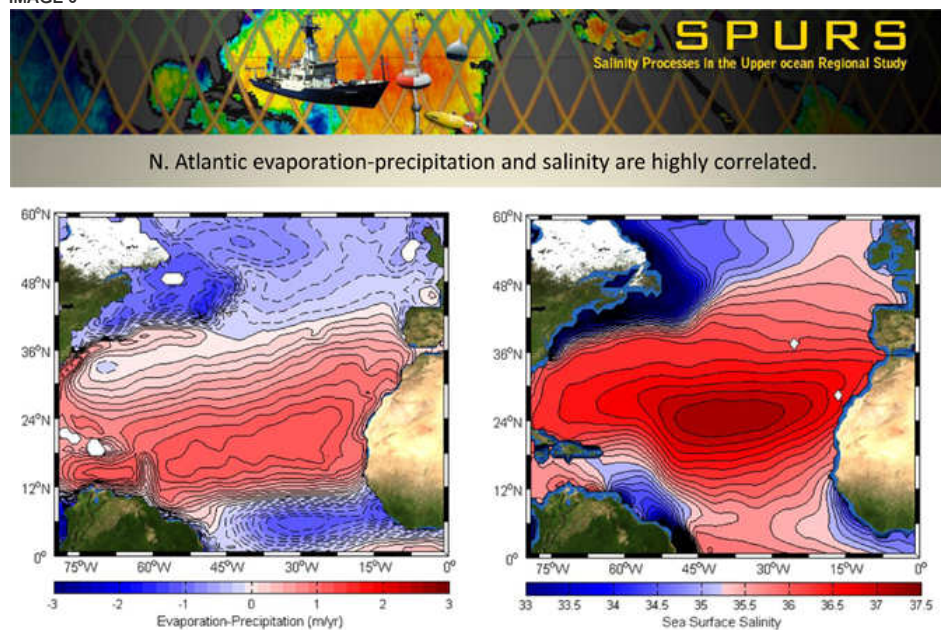
The ocean retains a better record of changes in precipitation than the land, and translates these changes into variations in the salt concentration of its surface waters.

IMAGE 5



The salty areas of the ocean are getting saltier, while fresh areas are getting fresher. This indicates a strong intensification of the water cycle over the last decades.

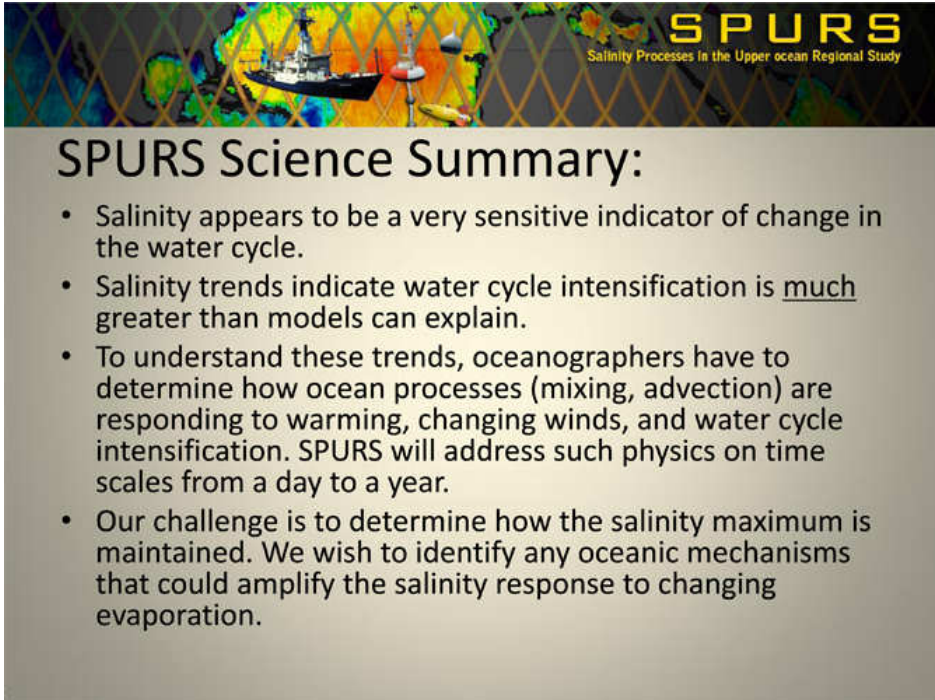
IMAGE 6



Note: the E-P zero line is close to vegetation/dry land boundary in Africa

The changes in global ocean salinity are larger than what climate models can explain. SPURS is designed to investigate this discrepancy and examine the oceanic processes influencing surface salinity.

IMAGE 7



SPURS
Salinity Processes In the Upper ocean Regional Study

SPURS Science Summary:

- Salinity appears to be a very sensitive indicator of change in the water cycle.
- Salinity trends indicate water cycle intensification is much greater than models can explain.
- To understand these trends, oceanographers have to determine how ocean processes (mixing, advection) are responding to warming, changing winds, and water cycle intensification. SPURS will address such physics on time scales from a day to a year.
- Our challenge is to determine how the salinity maximum is maintained. We wish to identify any oceanic mechanisms that could amplify the salinity response to changing evaporation.

Dave Fratantoni

IMAGE 8



SPURS
Salinity Processes In the Upper ocean Regional Study

SPURS IN-SITU MEASUREMENTS

Dave Fratantoni
Woods Hole Oceanographic Institution

Woods Hole Oceanographic Institution, 5 September 2012




IMAGE 9

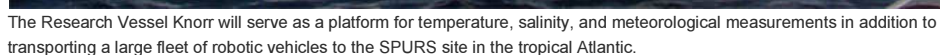


IMAGE 10

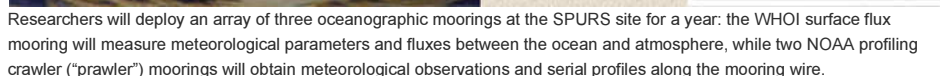
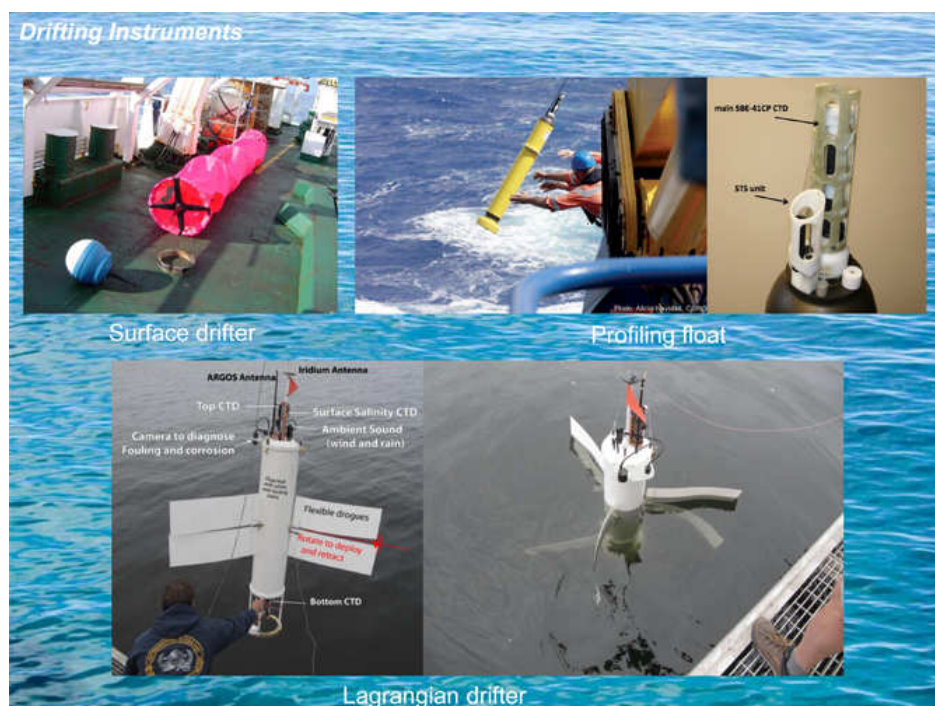


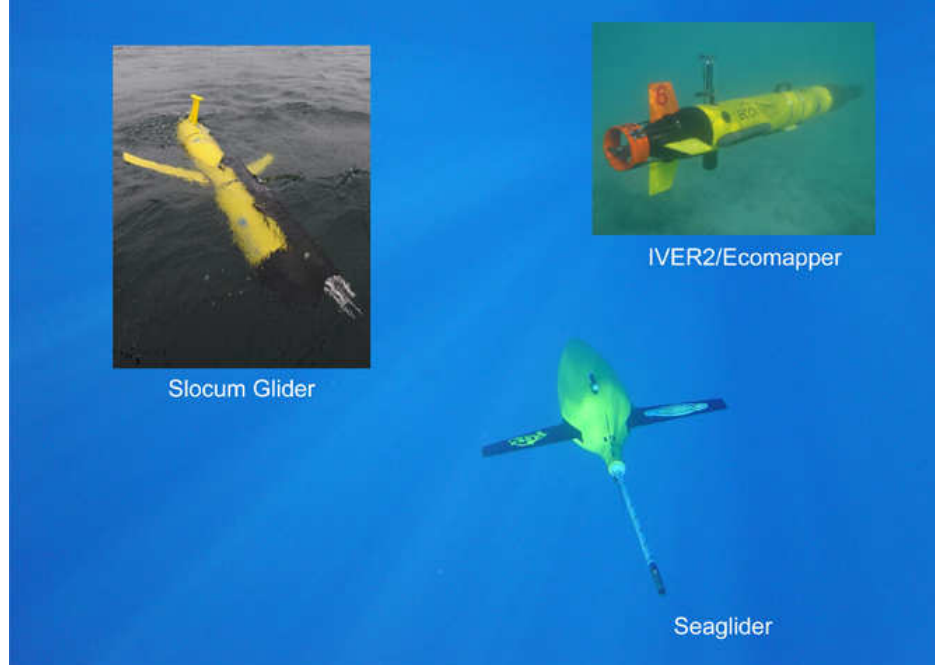
IMAGE 11



Satellite-tracked surface drifters will track water movement. SPURS will deploy profiling floats, modified from those used in the global Argo program to measure near-surface salinity, wind speed, and rain rate, and Lagrangian (free-floating) drifters equipped with multiple sensors to accurately track three-dimensional water movement.

IMAGE 12

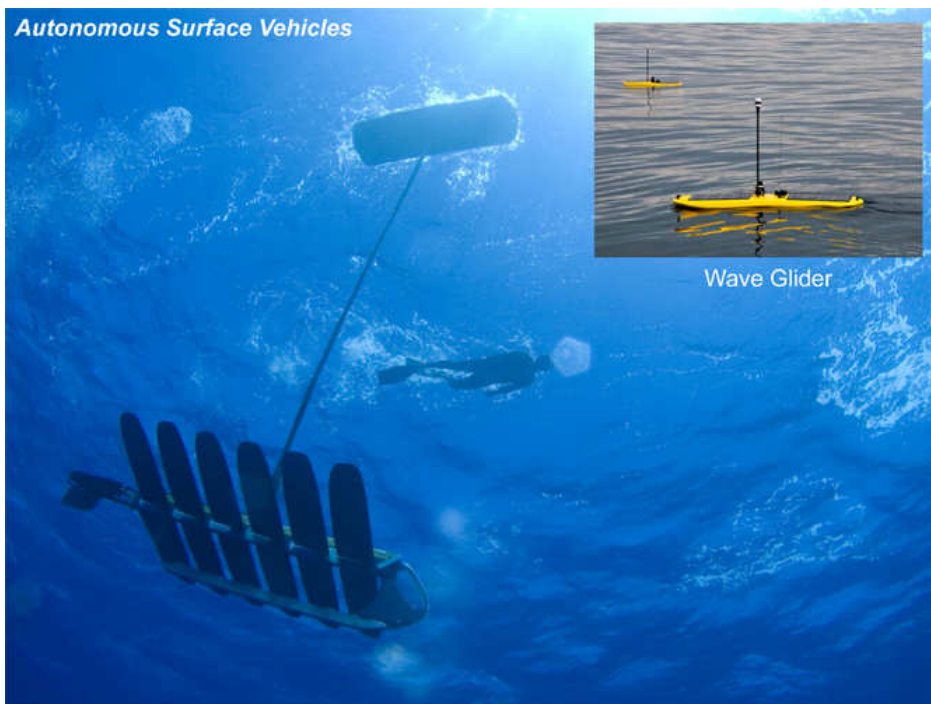
Autonomous Underwater Vehicles (AUVs)



SPURS will use several types of autonomous underwater vehicles. Two propeller-driven IVER2/Ecomapper vehicles will conduct short-term and small-scale surveys of salinity features. Two buoyancy-driven Slocum Gliders equipped with microstructure sensors will observe the intensity of ocean mixing. Three high-endurance, buoyancy-driven Seagliders will measure temperature, salinity, and microstructure in a 93-mi (150-km) box surrounding the SPURS moorings for a year.

IMAGE 13

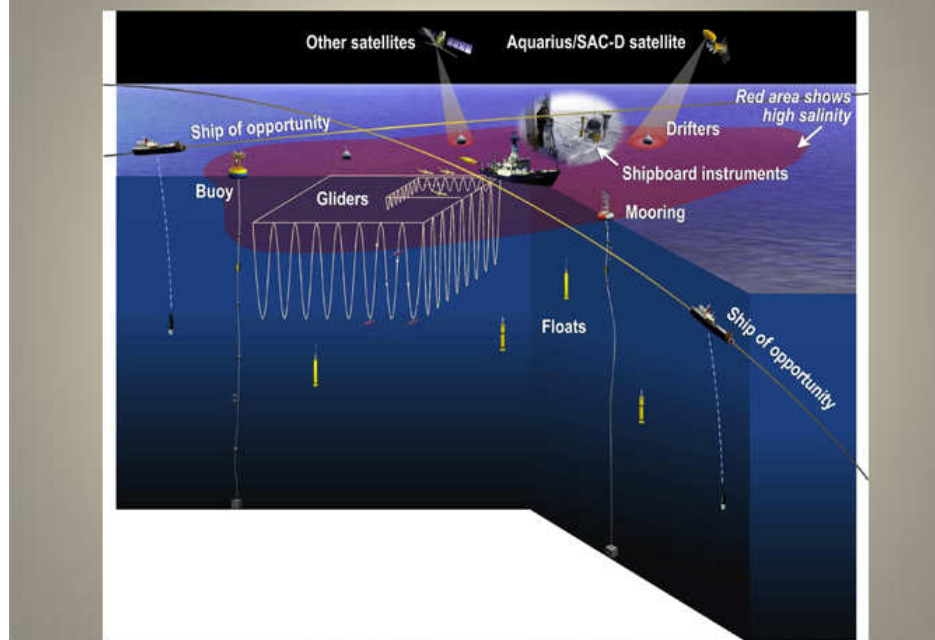
Autonomous Surface Vehicles



Three sun-powered wave gliders equipped to measure temperature, salinity, and meteorological conditions will occupy a 62-mi (100-km) region near the SPURS moored array for a year.

IMAGE 14

Nested Sampling Strategy



SPURS will use a nested observational strategy: expendable devices and ships-of-opportunity will collect temperature and salinity measurements over a wide geographic area in the central tropical Atlantic. Moorings and small fleets of robotic vehicles will provide a sustained year-long presence in a smaller observational area. During research cruises, ship-deployed platforms will make high-resolution measurements of even smaller oceanographic features.

Eric Lindstrom

IMAGE 15

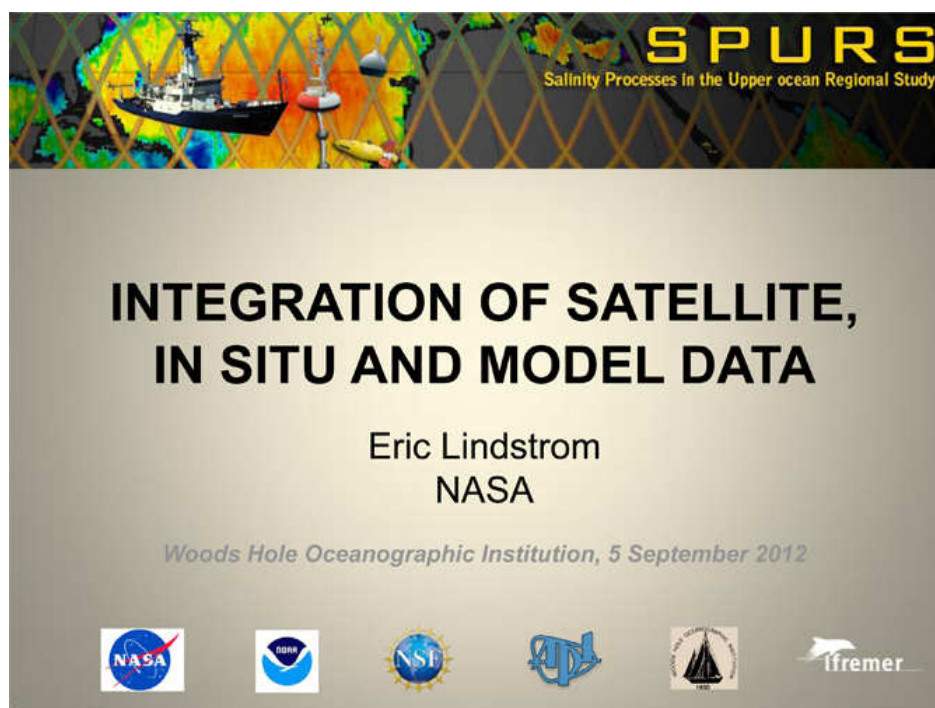
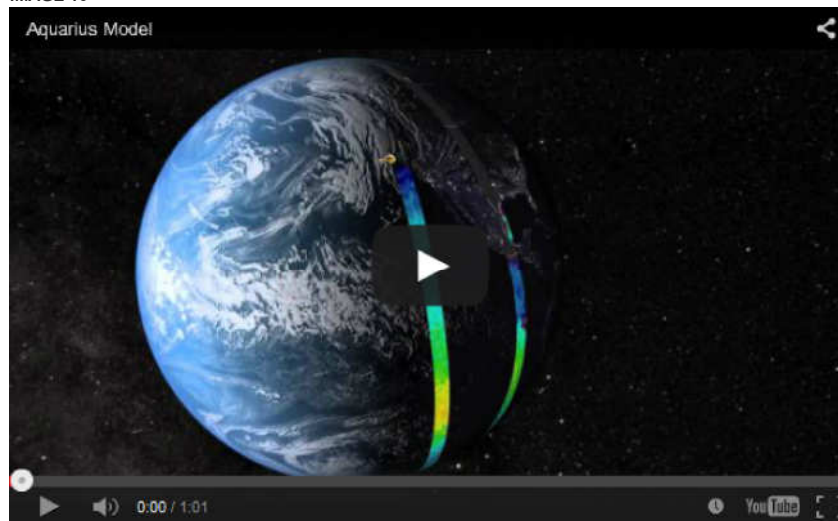


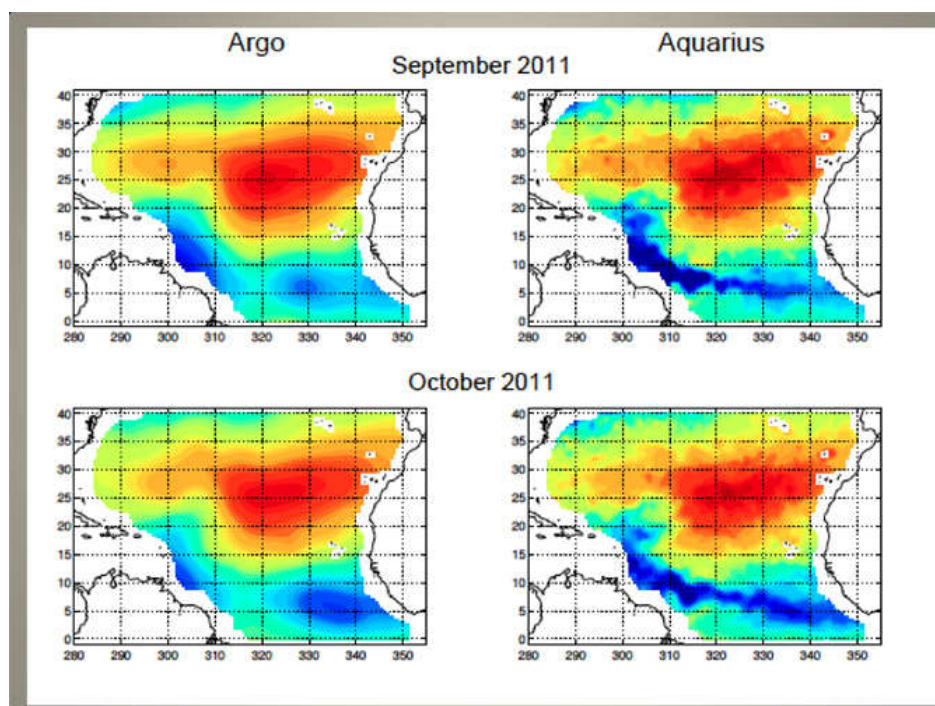
IMAGE 16



(Credit: NASA's Goddard Space Flight Center)

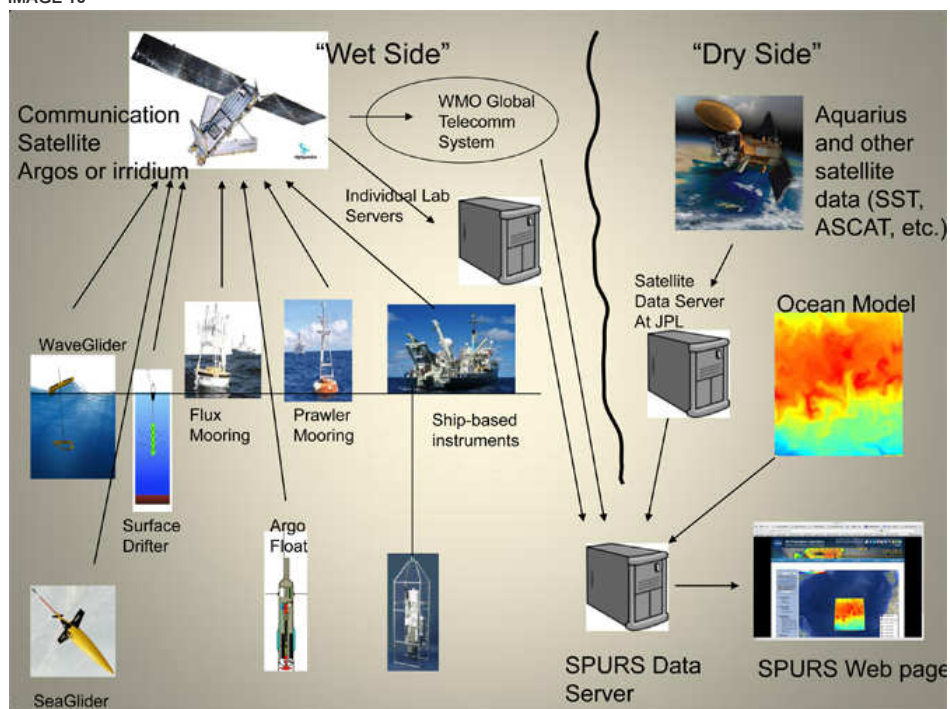
[Download video \(31 MB mov\)](#)

IMAGE 17



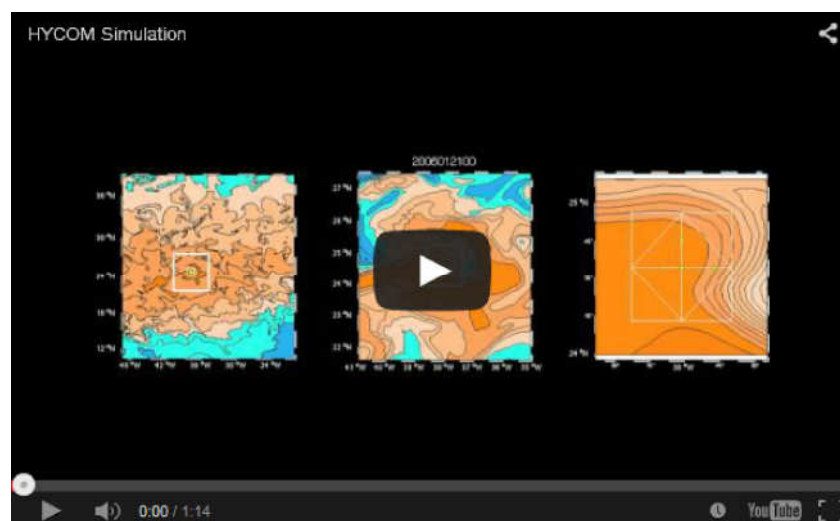
NASA's Aquarius instrument has been collecting ocean surface salinity measurements from space since August 2011 and using data from Argo, a global array of thousands of drifting profiling floats measuring the temperature and salinity of the upper layers of the ocean, for comparison and validation.

IMAGE 18



The data collected by the SPURS devices will be relayed via satellite to shore and integrated with numerical ocean models and satellite observations.

IMAGE 19



(Credit: Dave Fratantoni, Woods Hole Oceanographic Institution)

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